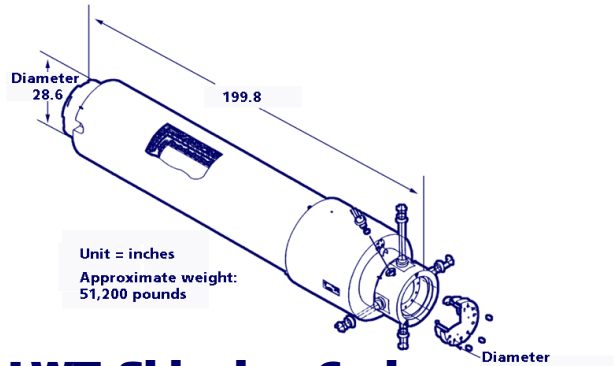
5. Shipping Containers

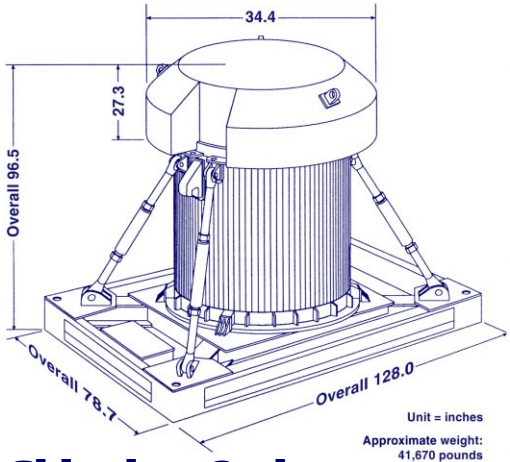
5.1 What type of container is used to transport spent fuel from foreign research reactors?

Spent fuel assemblies are shipped in special containers, called Type B transportation casks. These casks are ruggedly constructed and designed to retain their contents in the event of an extreme accident and to limit radiation emitted to allowable levels. For example, one Type B cask design that DOE has used frequently to transport spent nuclear fuel weighs nearly 26 tons, is constructed of steel and lined with lead, and has walls approximately eight inches thick.

The NAC-LWT cask is an example of a Type B cask used for shipping foreign research reactor spent fuel. Its body consists of a 0.7-inch-thick stainless steel inner shell, a 5.7-inch-thick gamma shield, a 1.2-inch-thick stainless steel outer shell, and a neutron shield tank.



NAC-LWT Shipping Cask



IU-04 Shipping Cask

The IU-04 cask is an example of a Type B cask used for shipping foreign research reactor spent fuel. The cask has two concentric walls of steel; the area between the steel walls is filled with lead for radiation shielding.

5.2 Who sets standards for Type B spent fuel casks?

The NRC sets design, fabrication, operation, and maintenance requirements for casks that are to be used within the United States. These requirements are consistent with international standards set by the International Atomic Energy Agency, a United Nations agency that serves as the central international forum for scientific and technical cooperation in the nuclear field.

Designs that meet the standards receive a Certificate of Compliance from a national authority (known as the "Competent Authority") responsible for certifying casks designed or used within its national boundaries. DOT is the Competent Authority for the United States and is also responsible for certifying foreign-designed casks intended for use in the United States. To receive DOT certification, foreign casks must demonstrate that they meet NRC standards.

5.3 Are Type B spent fuel casks tested for their ability to withstand potential accident conditions?

To meet NRC requirements, Type B spent fuel cask designs must be able to pass a series of tests designed to demonstrate their ability to withstand hypothetical accident conditions. To gauge their cumulative effects, the following tests are run, in the sequence listed, on cask designs that are candidates for certification:

- **Free drop**
  A 30-foot drop onto a flat, unyielding surface, striking the package's weakest point

- **Puncture**
  A 40-inch free drop onto a 6-inch diameter steel rod at least 8 inches long, at the package's weakest point

- **Thermal**
  Total engulfment in a fire of 1,475 degrees Fahrenheit for 30 minutes

- **Immersion**
  Complete submersion under at least 3 feet of water for eight hours

Following these sequential tests, a separate, undamaged cask of the same design must be immersed under 50 feet of water for eight hours.

In addition, the cask must be designed to withstand submersion in 660 feet of water for one hour.

5.4 Is each Type B shipping container subjected to full-scale testing?

Testing requirements apply to each container design rather than to each shipping container. To demonstrate their ability to withstand the required tests, container designs may be compared to designs of similar containers that have been certified safe; subjected to engineering analyses, such as computer-simulated tests; or subjected to scale-model or full-scale testing. A combination of methods is usually used.

5.5 Have Type B spent fuel casks been subjected to tests that simulate actual transportation accidents?

Over the years, experts have performed several tests on Type B casks intended to replicate extreme accidents:

- In 1977, at Sandia National Laboratories in Albuquerque, New Mexico, casks on trucks were rammed at 60 miles per hour and then at 80 miles per hour into a concrete wall. The casks survived without significant damage.

- In another 1977 test at Sandia National Laboratories, a locomotive moving at 80 miles per hour smashed broadside into a cask on a tractor-trailer parked across the track. Next, a rail cask was mounted on a railway car that was crashed into a concrete wall at 80 miles per hour. Afterward, the testers engulfed the cask in fire for one and a half hours. The cask survived with only minor damage.

- At a British Rail test track in the United Kingdom in 1984, a 140-ton diesel train traveling 100 miles per hour was crashed into a spent fuel cask. The train's locomotive was crushed, but the cask remained intact with only minor damage.

- In another test conducted by Sandia National Laboratories, a cask was dropped from 2,000 feet onto hard soil with a consistency similar to unreinforced concrete. The cask hit the ground at 235 miles an hour and buried itself 54 inches into the soil. The only damage to the cask was superficial paint scratches.

5.6 What is the accident record for vehicles that have transported Type B casks of spent nuclear fuel?

Since 1965, there have been more than 2,500 shipments of Type B casks containing spent nuclear fuel in the United States. In no case has a cask been breached or released its contents.

Eight transportation accidents involving Type B casks have occurred in the United States since 1965. The accidents ranged from relatively minor (a trailer carrying a cask separated from its tractor in a construction zone, but the trailer stopped within three feet) to severe (a truck carrying spent fuel left the road to avoid a collision with a car, the cask was thrown free into a ditch, and the driver of the truck was killed).

In only four of the eight accidents did the casks contain spent fuel, and in none of those cases did the cask release its contents. In three of those cases, the cask sustained no damage; in one case, the cask sustained superficial damage. In the accidents involving empty casks, three casks sustained no damage and one cask sustained superficial damage.